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FREE COMPOSITE GRAFTS OF THE NIPPLES IN MAMMARYPLASTY

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PLASTIC reconstructions of hypertrophied breasts combined with free transplantation of the nipples as herein presented is a simplified and safe procedure. The end results are consistently better in that the nipples are not transplanted until the partial amputation and shaping of the breasts have been completed.

Various methods of breast reconstruction have been described wherein the nipples were transplanted either by some form of pedicle graft, or intact with the breast tissue. Lotsch,[1] in 1923, utilized pedicle transplants of the nipple in skin plastic operations for improving the appearance of the simple ptosed breast. Lexer and Kraske[2] in 1923 employed a somewhat similar technic, combining it with excision of a wedge-shaped segment of tissue, in mammaryplasty for the hypertrophied breast. Passot,[3] in 1925, described a procedure whereby the nipple was transplanted intact with the underlying breast tissue to a previously prepared site above; the redundant breast tissue below was then excised and the skin edges were sutured in the submammary fold. Joseph,[4] also in 1925, described a two-stage method of transplantation of the nipple with the underlying breast tissue to its new location as a first stage, followed by removal of the redundant breast tissue as a second stage. Axhausen,[5] in 1926, introduced his method of undermining the skin over the entire breast, permitting a free upward shifting of the breast with the nipples. The excess breast tissue below was then

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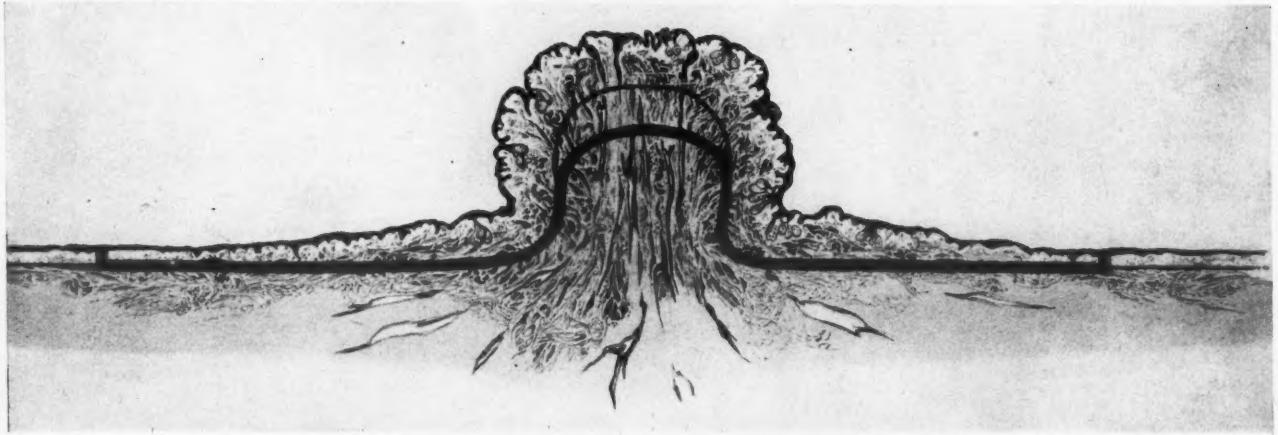

Fig. 1. Incisions for removal of nipple and areolar grafts. The heavy line represents an incision approximately ¼ inch from the surface; this includes the maximum amount of smooth muscle which one should attempt to graft with the nipple. The fine line represents an incision at a depth of ⅛ inch, which includes the minimum amount.

removed. The principle of these and other operations along similar lines has been preservation of the blood supply of the nipples and prevention of necrosis, and the conservation of function.

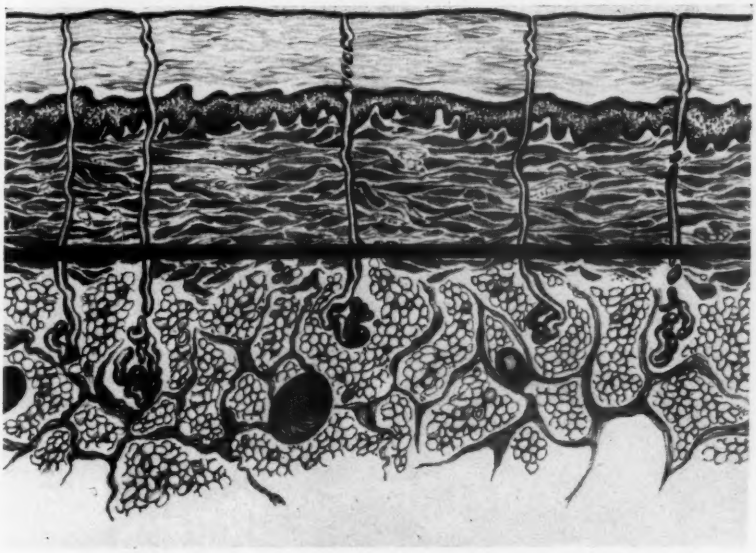

Fig. 2. Line of incision for preparation of the graft bed. The basal layer of the skin is conserved in order to provide a rich capillary blood supply for the grafts.

The use of free transplantation of the nipples appears first to have been introduced by Thorek[6] in 1922. In his procedure, however, the nipple is transplanted before the breast is reconstructed. Regardless of one's artistic sense, it is almost impossible to avoid placing the nipples too high or too far medially or laterally until the plastic operation on the breast is completed. The advantage of doing the mammaryplasty before transplanting the nipples was impressed upon the author by the results in one of his cases wherein the nipple transplantation was carried out as the first step in the procedure. In this case, the nipples were placed too high upon the breast.[7]

In the technic described herein, the nipples and areolae, together with a portion of the underlying smooth muscle tissue, are transplanted as free grafts. The basal layer of the skin with its abundant blood supply being utilized to form the recipient site, these grafts may be expected to take as readily as ordinary full thickness skin grafts. The normal tactile sensation and appearance of the

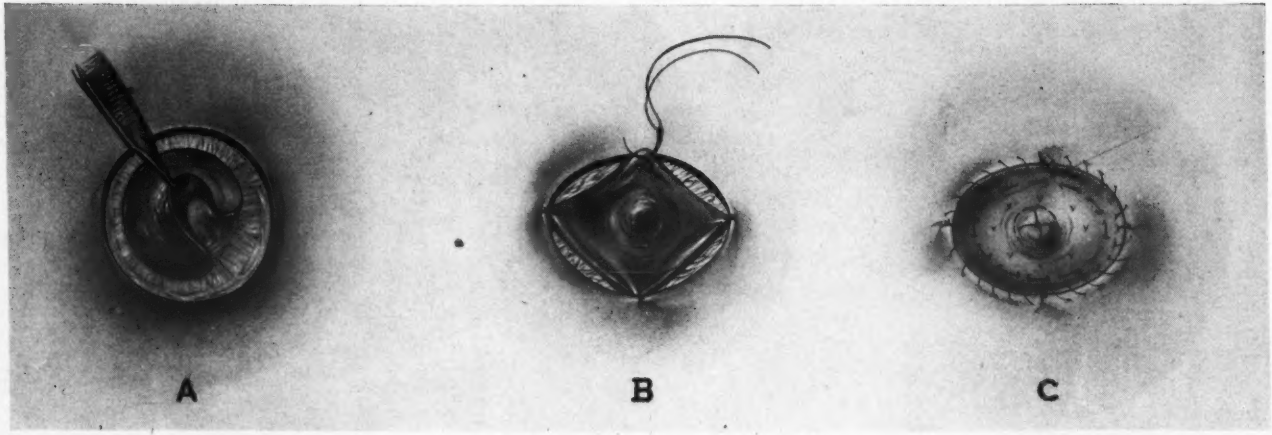

Fig. 3. A. Illustrating the dissection of the nipple and areola including a portion of the smooth muscle of the nipple.

Fig. 3. B. First step in the application of the nipple and areolar graft to its new location. Four retention sutures are used to insure an even distribution of the graft.

Fig. 3. C. Technic used in suturing the graft to its new site. A simple continuous suture is placed around the periphery. The central portion is quilted to the recipient area by running sutures.

nipples are restored, and a portion of the smooth muscle being included in the grafts, the nipples regain erectile function. The procedure is likewise advantageous in that it may be completed in one stage. It is recommended especially for over-large non-functioning breasts. From the author's observation, however, even in young women, the lactating function of these extremely hypertrophied breasts is almost invariably impaired, if not entirely lost.

Technic. The nipples and areolae may be dissected free under local anesthesia, thus reducing the time of the general anesthesia for amputation and shaping of the breasts, or, the breasts may first be amputated under general anesthesia and, while the remaining tissue is being shaped and the graft beds are being prepared, the nipple grafts may be dissected from the amputated portions of the breasts by an assistant. The latter method is preferable, in that less time is consumed in the operation. After the breasts are amputated and the incisions closed, the general anesthetic is discontinued and local anesthesia is used for preparation of the recipient areas and application of the grafts.

In estimating the amount of breast tissue to be excised, the age of the patient and the size and shape of the entire body should be taken into consideration. Parallel semilunar lines of incision are marked on the posterior and anterior surfaces of the breasts. The lower incisions are placed along the inferior margins of the submammary folds; if placed above the folds, they will be plainly visible after healing takes place. If the breasts extend into the axilla or laterally onto the chest wall, the lower incisions are carried upward into the subaxillary region, or lower down so as to be covered by the patient's brassiere.

The patient is then placed in the sitting position, in order to permit one to mold the contour of the breasts properly and to observe their position on the chest wall. When the shaping is completed, the subcutaneous tissues are brought together and sutured with No. 00 plain catgut. It is important that the subcutaneous tissues be closed snugly; in the event of liquefaction of the fatty tissue beneath, this prevents exudation of oil through the skin margins and possible separation of the incision. If necessary, the shape of the breasts may be materially altered by the use of retention sutures of No. 0 plain catgut through the mammary tissue itself. The skin is closed with interrupted sutures of No. 1 Deknatel placed about ½ inch apart, and a continuous suture of No. 000 Deknatel silk.

In all hypertrophied breasts, the areolae are also abnormally large, in some cases being as much as 5 inches in diameter. It is usually desirable that the nipple and areolar grafts be 1½ to 2

inches in diameter. After the proper size is determined, dissection is begun at the periphery of the areola and carried toward the nipple as a free full thickness skin graft. As the nipple is approached, the dissection is gradually carried deeper to include a small amount of the smooth muscle tissue. Beneath the nipple itself,

Fig. 4. *A*. Completed immobilizing elastic dressing.

the incision is carried upward toward the surface in saucer fashion, to avoid making the graft too thick at this point (fig. 1). The nipple portion of the graft should be at least ⅛ inch thick in order to include a part of the smooth muscle tissue; it is not recommended, however, that any part of the graft be more than ¼ inch in thickness.

The unused portion of the areolae of the amputated breasts are dissected free, wrapped in vaseline gauze and cellophane, and stored in the refrigerator for use in the event the nipple grafts themselves fail to take. One may use refrigerated skin grafts as late as ten days or two weeks postoperatively, with reasonable assurance of a satisfactory take. Although the author has never lost a nipple graft, it is well to keep the additional areolar tissue as a precautionary measure.

After the shaping of the remaining breast tissue is complete and the submammary incisions are closed, the patient is again placed in the sitting position and the sites for the nipple grafts are chosen. Recipient areas corresponding in size to that of the grafts are outlined, and the enclosed skin is dissected free to include almost the full thickness of the skin (fig. 2). One should avoid carrying the

Fig. 4. *B.* Dressing partially removed to show the different layers applied in the following order: Xeraform gauze, dry gauze, rubber sponge, dry gauze and elastic adhesive.

dissection so deep as to expose the subcutaneous fatty tissue, as this makes a poor surface for free grafting. The basal layer of the skin, having a rich blood supply, makes an ideal bed for the graft.

The nipple and areolar graft is evenly distributed over the recipient site and fastened in place with four diametrically opposed sutures (fig. 3). A continuous suture is then placed around the periphery. To insure perfect contact between the graft and its bed, and to prevent slipping of the graft and oozing of blood or serum from beneath, the entire nipple and areola are quilted to the basal layer of the skin with several rows of running stitch sutures. A dressing composed of one layer of rayon or vaseline gauze, a layer of dry gauze about ⅛ inch in thickness, and a layer of soft rubber

Fig. 5. *A*. Case 1. Front view of breasts before operation.

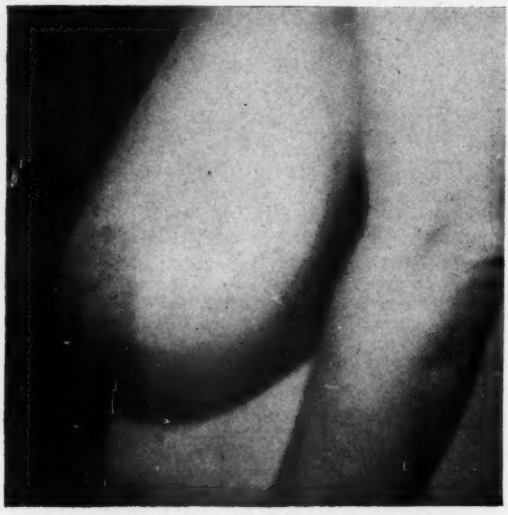

Fig. 5. *B*. Case 1. Side view of breasts before operation.

sponge about ¼ inch thick is placed over the nipple, the part of the rubber sponge which is directly above the nipple being saucerized to prevent undue pressure upon this elevated portion of the graft. Another thin layer of gauze is laid over the rubber sponge, and this

part of the dressing is held in place with elastic adhesive. Layers of fluffy gauze are then applied over the entire breast and secured by an ace bandage around the chest. Part of the bandage is carried

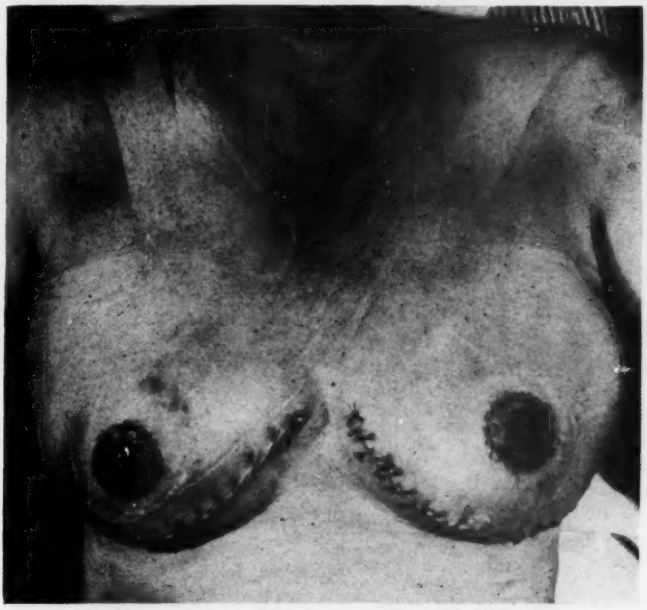

Fig. 6. Case 1. Appearance of nipple and areolar grafts at the first dressing, 10 days after operation. The "take" of the grafts is complete.

over the shoulders to provide an uplifting support (figs. 4A and B). The importance of proper bandaging cannot be too strongly emphasized, since the success of the operation largely depends upon its application.

As a precaution against stitch scars, the large dressings and the submammary sutures are removed after 6 or 7 days. Unless some complication arises, the dressings over the nipple grafts should not be disturbed for 10 or 12 days. Patients who live in the city may be allowed to leave the hospital on the third or fourth day and return to the office for dressings. It is best that out of town patients remain in the hospital until after the tenth or twelfth postoperative day.

Case Reports

Case 1. Mrs. E. G., a white woman, aged 42 years, had first noticed an abnormal enlargement of her breasts at the age of 20. They had continued to

Fig. 7. *A.* Case 1. Breast 7 months after partial amputation and plastic reconstruction, with transplantation of free composite nipple and areolar grafts. The nipples are distinctly elevated above the areolae.

Fig. 7. *B.* Case 1. Enlarged photograph of breast, side view, taken 7 months after operation, showing definite elevation of the nipples above the surrounding areolae.

increase in size, and at the time of observation their massiveness was causing her considerable annoyance and discomfort.

The patient had never had any serious illnesses nor any operations. She had begun menstruating at the age of 17, and until she was 32 her periods had been irregular. Since that time, they had been regular, at 28 day intervals, and of 4 or 5 days' duration. During menstruation, she experienced an uncomfortable sensation of fullness in the breasts, and the nipples were often so sore and tender that the patient was unable to wear a brassiere and had to remain in bed. She had been married for 19 years, but had never been able to become pregnant.

Fig. 8. Case 1. Enlarged postoperative photograph, showing in detail the appearance of grafted nipple and areola.

Except for a massive enlargement of both breasts and a generalized obesity, the physical examination was essentially negative. The breasts fell below the umbilicus, and by the usual methods, would have necessitated a multiple stage mammaryplasty (figs. 5A and B). For this reason, it was felt that a free transplantation of the nipples and areolae would be most advantageous. The procedure was therefore carried out as described above.

The tissue removed from one breast weighed 1600 Gm. and from the other 1650 Gm. There was no pathologic evidence of disease.

The patient's convalescence was uneventful. She had one degree of fever the first postoperative day but none thereafter. Mild sedation was required for 3 days. The dressing was inspected daily for evidence of undue pressure, odor or drainage. Upon its removal on the tenth day, the grafts were found to have fully taken (fig. 6). All the sutures were then removed and an elastic pressure bandage was applied. The bandage was worn for 2 weeks; thereafter, sufficient pressure and immobilization were maintained by a well fitted brassiere.

Three months following operation, tactile sensation of the nipples and areolæ

Fig. 9. *A*. Case 2. Front view of breasts before operation.

Fig. 9. *B*. Case 2. Side view of breasts before operation.

began to return. They were quite normal in appearance, and the nipples were definitely elevated above the areolar tissue. On massage, there was a distinct erection of the nipples and a constriction of the immediately surrounding areolae, indicating a return of function of the grafted smooth muscle tissue.

The patient was last seen 2 years postoperatively. At that time, the scar lines around the areolae and in the submammary fold were barely perceptible,

Fig. 10. *A*. Case 2. Front view of breasts after operation.

Fig. 10. *B*. Case 2. Side view of breasts after operation.

the breasts were well proportioned, were smooth and firm throughout, they contained no areas of tenderness or soreness, and the nipples and areolae were perfectly normal in appearance. Erection of the nipples was elicited by tactile stimulation, and the patient stated that sensation in the nipples was normal (figs. 7A and B, and 8).

CASE 2. Mrs. D. T. P., aged 45, white, complained of a heavy, dragging sensation of the breasts, and pain in her neck and anterior clavicular regions. She had gained 30 pounds in weight during the previous year, half of it, according to her statement, having been in the breasts. She had had three pregnancies, and at this time was going through the menopause. The remainder of the history was irrelevant. The breasts were extremely large and pendulous, falling well down upon the abdomen (figs. 9A and B). The physical examination otherwise was negative.

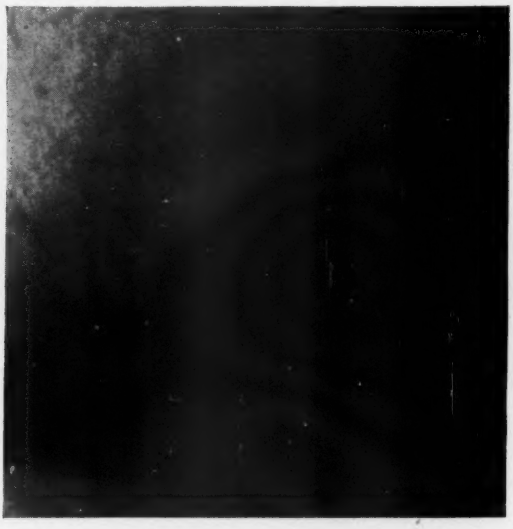

Fig. 11. Case 2. Enlarged postoperative photograph of nipple after tactile stimulation.

A sub-total amputation of each breast was done and the nipples were transplanted as free composite grafts. From one side 1350 Gm. of tissue was removed and from the other 1200 Gm. The patient's postoperative course was smooth throughout. She required no sedation after the first day. Her temperature rose to 100° the second postoperative day but subsided within a few hours and remained normal. Healing of the incisions proceeded without interruption and, upon removal of the dressings on the ninth postoperative day, the take of the grafts was complete. An elastic pressure bandage was applied and the patient was dismissed from the hospital on the tenth day. The bandage was removed after 2 weeks, the patient being instructed to continue wearing a brassiere for support of the breasts.

The patient was last seen 2 years postoperatively. At that time she stated that she had had no pain or discomfort in her shoulders since the operation and had enjoyed a sense of general well being. No masses nor areas of tenderness were elicited on palpation of the breasts. The nipples and areolae were normal in color and texture and the nipples readily erected in response to tactile stimulation. The patient stated that tactile sensation was present and was easily distinguishable from sensation in the skin of the breast (figs. 10A and B, and 11).

CASE 3. Mrs. J. B. R., white, aged 47 years, complained of pain in the shoulders and back, and abnormally large, drooping breasts. She stated that the breasts had been increasing in size for period of 20 years. The history

Fig. 12. A. Case 3. Front view of breasts before operation. Note inversion of nipples.

Fig. 12. *B.* Case 3. Side view of breasts before operation.

otherwise revealed nothing of any significance. She had had two pregnancies. Her menstrual cycle had always been regular and she was still menstruating

normally. On examination, the breasts were exceedingly large, hanging almost to the umbilicus, and the nipples were inverted (figs. 12A and B). Except for this and a generalized obesity, the examination was negative.

Fig. 13. *A*. Case 3. Postoperative photographs, front view, showing erection of right nipple after tactile stimulation, as compared with left nipple before tactile stimulation.

Fig. 13. *B*. Case 3. Postoperative side view.

A mammaryplasty was performed and the nipples were transplanted according to the author's technic, 600 Gm. of tissue being removed from one breast and 650 Gm. from the other. No gross pathologic changes were observed in the specimens. The patient's temperature was essentially normal throughout the postoperative period and her recovery otherwise was without incident. The dressings were removed on the tenth postoperative day. The grafts were found to have taken completely and the submammary incisions had healed pri-

marily. An elastic pressure bandage was applied, to be worn for a few weeks. Support was then maintained by a well fitted brassiere.

The patient was last observed 3 years after operation. She had remained entirely free of pain in the shoulders and back and discomfort in the breast

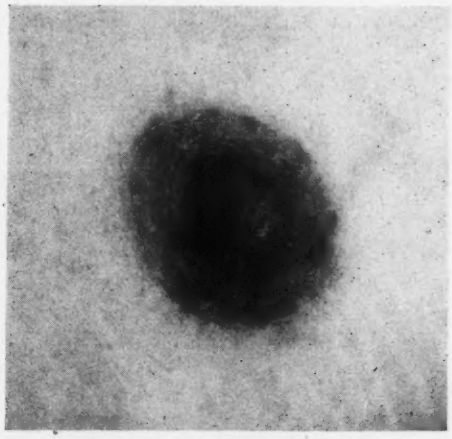

Fig. 14. *A*. Case 3. Close up enlarged photograph, front view, of nipple transplants three years after operation. The pigmentation is normal, the surface of the nipple is rough and irregular, and in response to tactile stimulation the nipples are definitely elevated above the surrounding areolae.

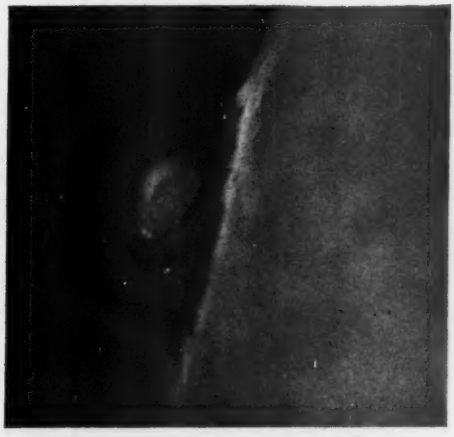

Fig. 14. *B*. Case 3. Close up enlarged photograph side view of nipple transplants three years after operation.

since operation. The breasts were smooth and firm throughout. The nipples and areolae were quite normal in appearance and, even without tactile stimulation, the nipples were elevated at least ¼ inch above the skin, in contrast to

their previous state of inversion. On stimulation, one observed a still further elevation (figs. 12A and B, and 13A and B).

Discussion

Close up lateral and anterior views of the postoperative results of these nipple transplants show that the grafts are perfectly normal in color and texture, that the nipples are definitely elevated above the surrounding areolae and skin, and that they are not mere grafts of pigmented skin suggesting a nipple. These results clearly refute Maliniac's[8] statement: "To those familiar with grafting of tissue, it is evident that it is impossible to transplant the nipple free by now available technics. Microphotographic illustrations of such grafts point to the presence of skin elements only. Proof of the possibility of free transplantation of the nipple would require microscopic evidence of muscular fibers and ducts obtained from sections of the transplanted tissue. Till now, such evidence remains lacking."

In the technic described, the superficial portion of the ducts is transplanted with the nipples and muscle tissue; the transplantation of the entire nipples is unnecessary, since the breasts in which this procedure is performed are usually without lactating function. The detailed structure of the nipple is shown in Figure 1. Microscopic proof of the presence of muscle fibers in these nipple transplants, as suggested by Maliniac, is unnecessary. The important fact is that the nipples do erect in response to tactile stimulation, and without muscle function this would not be possible.

Summary

The technic of mammaryplasty for hypertrophied breasts which is presented herein differs from those previously described, in that, first, the nipples and areolae are transplanted as free grafts following reconstruction of the breasts. Only by excising the redundant tissue and shaping the breasts before selecting the new sites for the nipples can one be sure of placing the nipples in their proper positions. Second, not only is the normal appearance and normal tactile sensation restored, but, a portion of smooth muscle tissue being included in the nipple grafts, erectile function of the nipples returns. The danger of necrosis is minimized by the use of the richly capillary basal layer of the skin for the graft beds. The procedure is likewise advantageous in that it may be completed in one stage. Three cases are presented illustrating the cosmetic and functional results of free transplantation of composite nipple grafts according to this method.

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RATIONAL TREATMENT OF BRAIN ABSCESS

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PUBLISHED communications concerning the treatment of brain abscess have largely been confined to a discussion of one method which has proved successful in the author's hands. It is the purpose of this communication to show that no one method is adequate for the control or cure of a brain abscess which may have a varying thickness of capsule or which may lie in brain of varying importance. It is further felt that if rational application of the various methods and treatment of brain abscess be applied to the individual abscess a relatively low mortality rate can be expected. The accompanying chart outlines this point.

The etiology of brain abscess is varied. A *post-traumatic* brain abscess may follow a compound skull fracture or any penetration of bone, meninges or brain which is not adequately cleansed. This is particularly true of gunshot wounds; so much so that Ascroft,[1] in his report on penetrating brain wounds during the past war, reported 25 per cent incidence of brain abscess following gunshot wounds of the brain. That this is a high figure, however, was revealed by the American Army statistics where total infection reached 20 per cent and brain abscess something less than 15 per cent. Trauma, therefore, remains a potent etiologic factor in the production of brain abscess.

Osteomyelitis of the skull secondary to adjacent infection, or following infection of the scalp, may cause, by passage of the infectious process through the emissary veins, an abscess to form within cerebral tissue. Such an abscess notoriously may form extra- or subdurally so that it is not accurately a brain abscess. It is treated with some difficulty because it is not prone to encapsulation.

Metastatic brain abscesses from infection elsewhere in the body are common. They are usually multiple, although this is not invariable. They may be caused by passage of infected emboli from such a pathologic focus as an ordinary boil or parenteral abscess, or they may be caused by an infected embolus from a lung harboring an infectious process, such as a lung abscess or an empyema. Such a process as actinomycosis of the lungs may cause a metastatic actinomycotic brain abscess, rarely treated with success.

The most common origin of brain abscess is that secondary to a *sinus infection* or a *mastoid infection* following a middle ear disease.

BRAIN ABSCESS

Source		*Number*	*Location*	*Treatment*	*Deaths*	*Per Cent*
Gunshot Wound of brain		27	Varied	Combined exteriorization with block resection. Instillation of penicillin	1	3.7
Sinus	Frontal	1	Deep frontal	Needling with instillation of penicillin	0	0
	Sphenoid	1	Deep frontal	Rubber drain, exteriorization and block resection	0	0
Metastatic from lung		1	Right temporal (multiple)	Exteriorization	1	100
Osteomyelitis of skull		3	Frontal	Exteriorization with block resection. Penicillin	0	0
Otogenic		4	3 Left temporal	2 total removal 1 block resection after exteriorization. Penicillin	0	25
			1 Cerebellar	Exteriorization and block resection. Penicillin	1	
TOTALS		37			3	8.1

These abscesses may form by proximity and expand by continuity. They may, however, pass through emissary veins and form some distance from the original focus of infection. The mastoid may notoriously form an abscess in the posterior temporal lobe.

Mycotic abscesses are apparently caused by tiny infected emboli lodging in the walls of a larger blood vessel within the brain and setting up an area of inflammation which then breaks down into an actual abscess formation.

The *pathology* of a brain abscess, regardless of etiology, consists of the arrival of infected material either by blood stream or by continuity. The bacteria multiply and the body then sends its scavengers to this area. Leukocytes and lymphocytes accumulate and the infected brain tissue is ingested. The brain itself sends gitter cells and the debris is broken down so that purulent materials accumulate. There is a secondary reaction of the brain in that endothelial and even, presumably, glial cells are converted to fibroblasts in an attempt at encapsulation. The degree of encapsulation is of particular importance in the treatment of brain abscess. Any encouragement which may be afforded this encapsulation is to be greatly desired, and this encapsulation is the reason for the delay prior to operation so necessary for successful eradication of the abscess.

Notoriously, any mycotic abscess rarely causes a great proliferation of fibroblasts and consequently appears more as an area of necrosis, or gross encephalitis, rather than an encapsulated pocket of purulent material. Hence, these are treated with great difficulty.

It has been proved that the bacteria which cause the abscess are incorporated in the capsule, or wall of the abscess. It is therefore essential that these virulent bacteria be removed, else the abscess will recur. This is accomplished only by the complete removal of the capsule of the abscess.

It has been further proved by Dorothy Russell[2] in England that the injection of thorotrast, as advocated by Kahn[3] of Michigan, stimulates the production of fibroblasts and consequently causes a thicker, stronger capsule.

It has been repeatedly proved at operation, and reoperation, that it is vitally necessary for every bit of the capsule to be removed before an abscess can be considered cured. It is also difficult to comprehend that penicillin may penetrate the interstices of a thick capsule and destroy the bacteria lying therein. That this is occasionally true, however, cannot be doubted.

The *symptomatology* of brain abscess is that of the symptom-

atology of brain tumor plus the knowledge of an infectious process elsewhere in the body which may be, or which notoriously is, connected with the circulation of the brain.

The classical symptoms of generalized increased intracranial pressure, that is headaches, vomiting and choked disc, are almost always seen in the presence of a brain abscess. It must be remembered, however, that there is a percentage of people in which it is anatomically impossible for a choked disc, or swelling of the optic nerve, to occur. In such a case, increased intracranial pressure must be verified by a cautious lumbar puncture. If a lumbar puncture is done, and *it should not be done in the face of a choked disc,* the fluid will reveal an increased spinal fluid pressure of varying degree associated with an increase in the total protein, as well as in the cell count. The type of cell will vary according to the depth of the abscess. If an abscess is located deep within the substance of the brain and not in proximity to the cerebrospinal fluid circulation, the cell type will be predominantly lymphocytic. If, however, the abscess is in proximity to the cerebrospinal fluid circulation, the cell type will be polymorphonuclear leukocytic.

The signs and symptoms which indicate the location of the abscess within the brain vary according to the neural structures involved. More often than not they are silent due to the fact they are harbored deep within the temporal lobe or within the frontal lobe, or within some part of the brain which displays no specific function.

Paralysis or paresis of an extremity will be reflected if the motor strip or any of its connecting neurons are involved. Aphasia will be exhibited if the left temporal lobe or the base of the left frontal lobe is involved. The optic radiations will reflect some type of peripheral visual field defect if they are encroached upon. Astereognosis will be noted if the parietal lobes are involved. Obtunding of cerebration is noted in almost all cases of increased intracranial pressure.

The cerebellum, notoriously subject to abscesses derived from the mastoid will, if involved, display various degrees of incoordination.

Intracranial pressure is increased tremendously due not only to the presence of the abscess, but due to the subsequent edema of the surrounding brain tissue. This is always great and is much more pronounced than is the case in a similarly located brain tumor. It is for this reason that decompressive measures or the use of hypertonic solutions may cause temporary relief until the capsule is thick enough to warrant surgical attack.

The *treatment of brain abscess* must, because of the various types

and locations of brain abscesses, be individual. Rational and intelligent treatment now allows us to bring into focus a great number of individualized attacks upon the abscess. Due to familiarity with handling of cerebral tissues and due to the newer antibiotics and antibacterial drugs, neurologic surgery has progressed far from the day that Macewen first drained an abscess by the use of decalcified chicken bone. However, until only a few years ago we had progressed very little beyond that stage. As short a time ago as 1940, and indeed in some instances still, we are using only a substitute for Macewen's chicken bones in the form of a rubber catheter or a rubber drain. It has been repeatedly seen that a hard rubber catheter may penetrate the adjacent wall of a ventricle, causing ventriculitis and death. It has been also seen that this same catheter may penetrate the distal wall of an abscess causing a daughter abscess to arise which may be missed in the evacuation and eradication of the primary abscess.

The *general treatment* of brain abscess must concern itself with decompressive measures so that *time may allow a thick capsule to form.* Without the presence of this thick protective capsule about an abscess, any treatment of the abscess is extremely hazardous and probably will end fatally. Therefore, we must allow nature to lay down a fibroblastic membrane and protect the rest of the brain from the necrosis and degeneration secondary to the bacterial invasion. While this is going on the patient is *generally supported,* his *fluid intake* is kept up to the body requirements and his *caloric requirements* are satisfied. It is well during the 3 to 4 weeks which this period may last, to institute a course of one of the *sulfa drugs,* the most practical and efficacious at this time apparently being sulfadiazine which penetrates the blood brain barrier to a greater degree than its kindred drugs, sulfathiazole, sulfapyridine or sulfanilimide.

During this time *parenteral administration of penicillin* is indicated. It is true that penicillin passes the blood brain barrier in only small amounts, and heretofore it has been deemed necessary to use penicillin intrathecally to attack a virulent cerebral process. However, it has been noted repeatedly that even the minute amounts which do pass through the blood brain barrier are effective against the organism within the brain. Also we do not know what happens to the blood brain barrier in the presence of infection in the cerebrum. It seems logical that its resistance to these drugs is broken down and that penicillin may cross the blood brain barrier in greater amounts than in the healthy normal individual. Accordingly, it is the author's practice to give penicillin intramuscularly, 30,000 units every 3 hours during the time of encapsulation and throughout the

postoperative period. It is also instilled directly into the abscess area during surgery.

The *headache* resultant from increased intracranial pressure can largely be controlled by means of such innocuous drugs as aspirin, phenacetin and small doses of codeine. It is also to be noted that 50 per cent sucrose, in contradistinction to glucose, will cause a decrease in the *cerebral edema* and resultant alleviation of headache. The *restlessness* is best combated by the use of paraldehyde since it does not depress the respiratory center. *Convulsions,* if they occur, should be controlled by the barbiturates, but caution should be used in the administration of any intravenous barbiturate or large doses of intramuscular barbiturate since they may affect the respiratory center.

There seems to be no indication for the use of lumbar puncture beyond the initial diagnostic one and that may not be necessary. *Promiscuous use of lumbar puncture is to be decried* and to relieve the cerebrospinal fluid pressure by releasing it from below, as in a lumbar puncture, is unphysiologic. A great amount of cerebral edema and intracranial pressure will force the medulla and its vital structures through the foramen magnum and may cause a prompt exodus. Therefore, lumbar punctures should not be used in this instance, for the reduction of increased intracranial pressure. If 50 per cent sucrose and hypertonic protein solutions cannot relieve the pressure, then it is best that surgical decompressive measures be applied.

It is advisable that at least 3 weeks be allowed an abscess for the process of sufficient encapsulation. This 3 weeks should be counted from the period of abscess formation, and the longer the period, so that a thicker, stronger capsule may be formed, the better the eventual prognosis for the patient. It is for this reason that during this critical period a *decompression* may become necessary. If that is so, the decompression should be made upon the side of the abscess, and should be made in the subtemporal region. If the abscess should be in the cerebellum or in the posterior fossa, the same principle should be observed and the decompression should be done supratentorially, rather than directly over the abscess. This innocuous surgical procedure is merely done for the purpose of defeating increased intracranial pressure during the time of capsule formation.

Once the general symptoms of increased intracranial pressure have been controlled and the abscess has been given sufficient time so that the surgeon thinks the capsule is adequate, then *specific*

measures directed against the abscess may be instituted. These have been variously described and for the purposes of clarity will be described below. Dandy[4] and many others have described the process of *needling an abscess* by means of a brain cannula and evacuating its content. This gives a good temporary result and the abscess may be repeatedly needled, although the danger of losing the abscess is great. That is, the abscess may become lost to the needle by means of daughter abscesses forming on the farther side of the capsule, or because the capsule containing the bacteria has enfolded upon itself.

In later years the *injection of penicillin* through the brain cannula has become fashionable.[5] The abscess is repeatedly needled and at each time of evacuation of the pus the penicillin is injected into the cavity.

Kahn has advocated needling an abscess and *injection of thorotrast* which stimulates capsule formation and which also allows the abscess to be followed by means of x-ray in its various migrations.

The King[6] method of unroofing an abscess and *marsupializing* it so that it may be packed and allowed to extrude through a small decompressive opening, just above the abscess, has given excellent results.

Vincent,[7] of France, and Fincher[5] have been the advocates of the *removal of an abscess in toto* as one would a tumor. This is theoretically the ideal method of dealing with an abscess.

During the recent war the American neurosurgeons used a *combination* of the King method of unroofing and marsupializing an abscess followed by block resection of cerebral tissue and capsule and injection of penicillin. This method worked very well in posttraumatic abscesses and seemed, indeed, the only one applicable.

It is evident that each of these various surgical procedures has its advantages and its advocates. To state, however, that any one method is superior to another would be less than the truth. It is firmly believed that these methods should be *all* applied to an abscess depending upon the abscess' *degree of encapsulation, its depth within the brain* and *its critical location in the brain.*

It is evident, then, that an abscess which has a thin capsule, such as is seen in a cerebellar abscess or in an abscess within the brain which has not had time to mature, but which must be operated upon to save a life, should be treated by repeated needling, injection of thorotrast and penicillin. The thorotrast will stimulate the proliferation of the capsule and the penicillin will attack the active bac-

teria. The abscess can be followed by x-ray and consequently not lost. If, after a suitable length of time, the x-ray shows that a thick capsule has formed, since the thorotrast will be taken up by the capsule, it can then be treated by block removal.

Conversely, an abscess in either of the frontal lobes or the right temporal lobe or either of the occipital lobes, with a thick capsule identified by means of a brain needle, can be removed in toto as advocated by Vincent. This is the ideal method of treatment of an abscess. The author has removed most of his otogenic abscesses by this means. He has had 2 patients both of whom had an otogenic abscess in the left temporal lobe with complete aphasia, of long-standing and with a thick capsule. These abscesses were removed by the author in toto, with a minimum of trauma. The aphasia immediately cleared, and the patients, of course, were cured.

It seems wiser, however, if one is to express generalities, that an abscess in the left temporal lobe or lying in the parietal lobe within the motor strip, should be treated by repeated needling with a brain cannula and injection of penicillin and thorotrast. This should theoretically cause less damage to surrounding vital brain tissue.

Occasionally an abscess is found lying at the base of the brain sometimes as a result of a fracture through the sphenoid sinus. The author unfortunately attacked one such abscess through a left frontal bone flap erroneously thinking that the abscess was a brain tumor. Fortunately after needling and leaving a small decompression this abscess extruded itself and could then be removed by means of a block electrocautery resection. This, however, is considered merely fortunate and it is felt that repeated needling with instillation of penicillin would be the method of choice. It is obviously impossible to apply King's method of unroofing such an abscess, and it seems unlikely that such an abscess would migrate the 15 centimeters necessary to reach the surface.

The *actual technic* of attack on an abscess can be described by saying that the patient is operated upon usually under local anesthesia. A small decompressive opening of approximately 3 or 4 centimeters round is made directly over the abscess. It may have been necessary to visualize the abscess by means of ventriculography. If there is any question as to the location of the abscess, this should by all means be done. It is *not recommended* that an encephalogram be done because of the great danger of herniation of vital structures due to the increased pressure above.

After the accurate localization of the abscess and the making of the small decompressive opening directly over the abscess, the dura

is cautiously opened. If no fluid escapes from the subarachnoid space, it means that this area of the brain has already been sealed off and it is then safe to go ahead with the operative technic. If, however, fluid does escape from this area, the dura, arachnoid and cortex should be sealed by means of the electrocautery. Another method of causing this adhesion of tissues is to place dry gauze about the opening so adhesions will be stimulated and formed. This usually takes about 3 days and the wound may then be reopened and the operation proceed.

The brain needle is cautiously passed in the direction of the abscess. The capsule will be felt as a firm, rubbery sensation corresponding to that of denting a tennis ball with the brain cannula. The degree of encapsulation can be judged by the amount of resistance to the needle and the resiliency of the capsule. The field is well packed off and the needle is then introduced, using some force, into the center of the abscess. The pus immediately escapes and is evacuated by means of an asepto syringe.

Depending upon the method of eradication of the abscess to be used, the surgeon may or may not evacuate the abscess. If he intends to use Vincent's method of total removal of the abscess, such as is used in the removal of a tumor, the capsule is not penetrated with the needle. This method is best applicable when the abscess lies no more than 3 centimeters below the surface. In such an instance, a cortical incision is made, after enlarging the decompressive opening or even necessitating the turning of a bone flap. The cortical incision is made down to the abscess and by means of wet cotton patties, the brain is wiped away from the capsule. Cotton patties are then cautiously introduced around the side and under the abscess, elevating it. Guy sutures may be inserted in a thick capsule to allow gentle traction to be placed upon the abscess. Vascularity is seldom a problem in such an instance and the mass may be gently tilted and lifted from its bed, the brain being wiped away by means of wet cotton, and the abscess removed entirely without breaking the capsule.

After the abscess is removed totally, the entire area is subjected to 50,000 units of penicillin instilled directly into the cavity and the wound closed tightly including the dura mater.

If, however, King's method of unroofing the abscess is to be used, the abscess is evacuated by means of a brain needle and two sutures placed in the capsule of the abscess after making a small cortical incision. The abscess is then opened fairly widely and completely evacuated, using a lighted brain retractor so that all the pockets

and outpouchings of the capsule can be visualized. The abscess is then packed by means of an iodoform handkerchief followed by iodoform strips and the capsule brought up and sutured to the dura, or if possible to the galea. This cavity is then redressed and repacked, sometimes necessitating a spinal puncture to allow the abscess cavity to unfold, every 3 to 4 days until the abscess extrudes itself. This method is particularly efficacious in silent areas, although King reports excellent results in vital areas such as the left temporal lobe and the motor strip.

If a combined method, utilizing King's marsupialization plus block resection, is to be used the procedure goes so far as allowing the abscess to extrude itself by half. At this time the entire area is enlarged and by means of electrocautery, brain as well as capsule is resected. Penicillin is instilled and the wound closed tightly.

If the decompressive opening is large and it is desired to repair the skull defect, this may be done 6 months to a year after the eradication of the abscess. Tantalum has been popular for this purpose. If a tantalum plate is used to cover the skull defect, it is wise to leave a fairly large hole in the center of the plate so the brain needle might be reinserted in case of reformation of the abscess. A plate may be used early to prevent cerebral fungation.

Summary

A recapitulation of various treatments of brain abscesses has been given. The author has desired to point out that *no one abscess can be treated with any one method.* It is rather desired to explain that the rational treatment of a brain abscess depends upon three factors: First, *the degree of encapsulation*, which is in turn dependent upon the time elapsed, as well as the bacteria involved. Second, *the depth of an abscess* within the brain and third, *the critical location of the abscess* within the brain. It is felt that the rational use or combination of the various methods of treatment will result in a lowering of mortality due to brain abscess. It is believed that Vincent's method of total removal of a brain abscess, in suitable cases, is the ideal one. It is also believed that King's method of marsupialization and extrusion of an abscess, or the combination of King's method followed by block resection of the capsule of an abscess, gives excellent results. In deep seated abscesses in vital areas, repeated needling of an abscess with instillation of penicillin and/or thorotrast is advocated. A table revealing the results of the author's attempts and the utilization of these various methods of treatment of brain abscess is presented. It is believed that mortality

from brain abscess can be reduced from circa 50 per cent down to 5 or 10 per cent.

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COMBINED COLOSTOMY AND MILLER-ABBOTT TUBE IN THE PREPARATION OF LEFT SIDED COLON LESIONS FOR SURGERY

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IN obstructing lesions of the left colon, cecostomy or transverse colostomy are the procedures usually used in their preparation for surgery. These lesions may be either neoplastic or infectious in nature; however, the principles of treatment are essentially the same: the obstruction must be relieved, and the bowel decompressed and prepared for the surgery required by the respective lesion. We have preferred transverse colostomy to cecostomy because this gives an opportunity to get some idea about the pathology present through a minimal amount of manipulation, and too many of our attempts in bowel decompression with cecostomies have failed in their purpose. A high percentage of the cecostomies that have functioned to our satisfaction have had to have some type of secondary closure, though it is agreed that the procedure is less than that required to close most colostomies. We, however, have had little difficulty in closing the colostomies when the proper time for closure and the conditions necessary for closure have been present. A Devine[1] type of defunctionalizing procedure is the type most frequently employed by us.

Millet[2] recently reported a procedure in which a cecostomy and the use of the Miller-Abbott tube were combined to prepare left sided colon lesions for surgery. We have used a similar, but of necessity modified procedure for the preparation of a colon lesion through the use of a transverse colostomy and the Miller-Abbott tube. It is this procedure that is the subject of this communication, and as far as can be ascertained, it is the first time this procedure has been used.

On the sixth postoperative day following a classical Devine[1] colostomy, a Miller-Abbott tube was introduced into the distal loop of the colostomy and the balloon of the tube inflated with 120 c.c. of air. When this was done the patient complained of some discomfort in the epigastrium but this was transitory. On the first effort to introduce the tube, a glass L tube was introduced into the colostomy but it was found that there was too much resistance be-

tween the Miller-Abbott tube and the glass tube to permit the passage of the Miller-Abbott tube. For this reason the glass L tube was dispensed with and the Miller-Abbott tube placed directly in the colostomy, similar to passing it through the nose. For the first

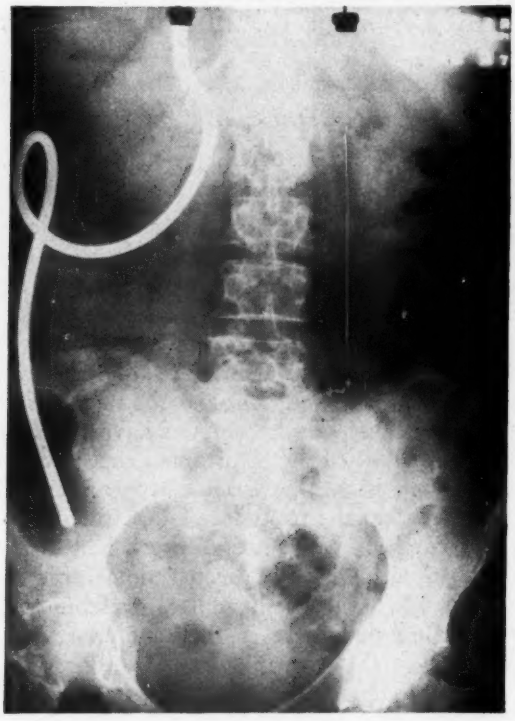

Fig. 1. X-ray film taken one hour after evident movement of the tip of the Miller-Abbott tube had begun. It shows the tip in the sigmoid colon.

half hour after the balloon was inflated no progress of the tube was noted. This was followed by a period of evident movement of the balloon and in approximately one hour the tip of the Miller-Abbott tube was in the sigmoid colon. It was the patient's impression that her position in bed could increase the rapidity of tip of tube movement. She thought that progress was more rapid if she was in a supine position. It must be remembered that the classical physiologic description of colonic movements is that of mass movement instead of frequent peristaltic waves as occur in the small bowel. This may well account for the temporary delay in tube progress when first inserted and for the rapidity of descent once movement

began. It is necessary that close watch be kept over the tube to insure some slack in the tube outside the abdomen. Figure 1 shows the tube and the inflated bulb in the sigmoid.

Fig. 2. X-ray film after the injection of 100 c.c. of thin barium showing a partially obstructing lesion due to diverticulitis in the lower sigmoid.

The use of the Miller-Abbott tube in this manner is advantageous for three reasons: 1. To deflate an obstructed left colon, 2. To prepare, through irrigation and "back flush," the left colon for further surgery, 3. For diagnostic x-ray study of lesions in the left colon. Figure 2 illustrates the diagnostic use of this procedure. A small amount (100 c.c.) of thin barium was injected into the Miller-Abbott tube into the vicinity of the, in this case, partially obstructing lesion of the sigmoid colon. In using this method of study, the danger of producing a complete obstruction in a partially obstructing lesion through the use of barium studies can be avoided because all of the barium can be immediately and completely removed from the colon by irrigation. This was done in the case presented.

In the introduction of the Miller-Abbott tube through the distal loop of the transverse colostomy a Wangensteen suction can be attached to the Miller-Abbott tube at the beginning of the procedure. This will not interfere with the passage of the tip of the tube carrying the inflated balloon. This procedure can be done on the day that the colostomy is opened and thereby insure a more rapid and complete deflation of the colon distal to the colostomy. In obstructing lesions, when the passage of the tube ceases, it is likely that the tip of the tube has reached the point of obstruction. We prefer, at that time, to take an x-ray film of the position of the tube and if our suspicions are confirmed, deflate the balloon. Irrigations resulting in a "backflush" of the left colon are then started. In that the majority of our patients are made ambulatory immediately following surgery, the irrigations are done with the patient sitting by the bed using an emesis basin or similar receptacle to catch the "back flush."

From experience, we find that approximately 300 c.c. of irrigating fluid can be placed in the left colon before it begins to return through the colostomy ostium. After the irrigation is completed, and we use approximately 1000 c.c. of irrigating fluid, Wangensteen suction is attached to the "suction limb" of the Miller-Abbott tube. The quantity of fluid obtained by suction varies up to 200 to 300 c.c. This procedure causes the patient no discomfort. The apparatus used in the irrigation consists of an ordinary infusion set and the irrigating solution can be tap water, normal saline, or a 6 per cent solution of sulfasuxidine or sulfathaladine. Irrigations are performed twice a day. If the sulfonamide compounds are to be used in a patient with a colostomy they must be used as an irrigating solution in that the compounds by mouth would have no effect on the colon distal to the colostomy.

We have found that the irrigating solution is optional and equally as good results can be obtained through the use of saline as the sulfonamide compounds. It probably is true that the bacterial count in the bowel would be reduced much more through the use of the sulfonamide irrigating fluid. In patients with partially obstructing lesions, this procedure obviates the use of enemas from below in that the irrigating fluid will pass through the partially obstructing lesion and results in an immediate evacuation of the bowel per anus.

Through the use of this method of preparing patients with left sided colon lesions, they can be prepared for their necessary definitive surgery in approximately one week. Following this procedure, we would not hesitate in operating upon the patient as soon as he is generally prepared for resection. The general preparation includes

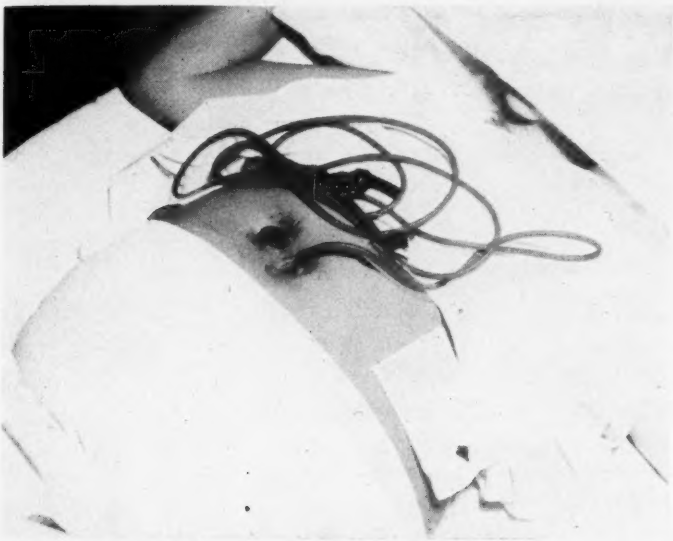

Fig. 3. A double barrelled Devine colostomy with the Miller-Abbott tube in the ostrum of the distal loop.

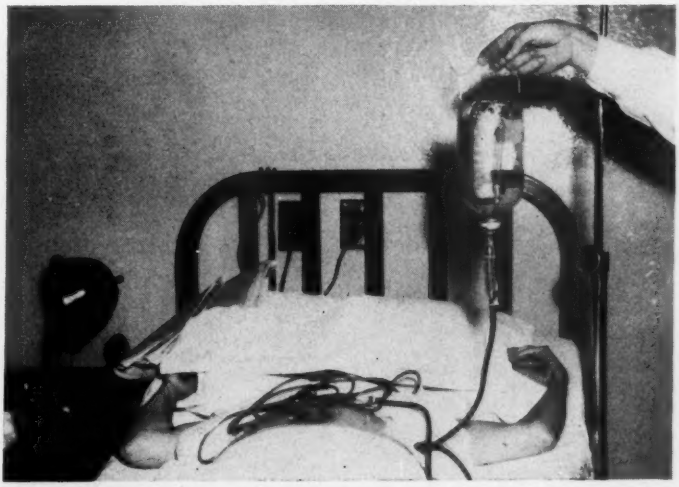

Fig. 4. The Miller-Abbott tube in the distal loop of the colostomy and the infusion apparatus attached to the "suction limb" of the Miller-Abbott tube.

systemic treatment, correction of fluid balance, vitamin deficiencies, etc. Millet's[2] suggestion of irrigating the bowel a few hours prior

to surgery, thereby insuring a clean and empty left colon, is followed by us.

Case Report

A 67 year old white, widowed, female, entered Frasier-Ellis Hospital complaining of pain in the lower abdomen, more pronounced in the left side and when standing, of 4 months' duration; constipation, moderately severe, for an unspecified number of years but severe enough to require enemas during the last 2 months; a loss of approximately 10 pounds of weight during the past year, and burning on urination of 4 months' duration. She had had no malena or hematuria. Systemic review was otherwise essentially negative. Her past history was important in that she had had a polyp removed from her cervix in 1926 and she stated that since that time she had had some discomfort in her lower abdomen. She had stopped menstruating 16 years previously and had had no spotting or vaginal discharge since that time.

Physical examination was essentially negative except for the pelvic examination which showed a cystocele and a rectocele of moderate severity, a scarred cervix with no erosion, and a large, irregular, moderately firm and tender nodular mass in the left side of the pelvis which extended toward and into the left iliac fossa.

The laboratory examination showed a red blood count of 3,640,000, white blood cells 17,800 and hemoglobin 72 per cent. There was a moderate shift to the left in the Schilling hemogram. Urinalysis on a catheterized specimen showed a trace of albumin, a rare hyaline cast and an occasional pus cell.

Electrocardiogram was essentially negative except for a moderate left axis deviation and a low QRS in Lead 1.

Her bladder was normal.

X-ray film of the chest was essentially negative.

At operation, the lower part of the descending colon and sigmoid was found to be the seat of a lesion which was firmly fixed to the peritoneum from the pelvic reflexion to the lower portion of the descending colon. It was firmly adherent to the bladder, the uterus, and the lateral peritoneal wall. Exploration of the abdomen was negative for evidence of metastasis. A large amount of edema involving the mass, the bowel and the appendices epiploicae was present. It was evident that this firmly adherent mass could not be mobilized and a classical Devine colostomy was performed. On the sixth postoperative day a Miller-Abbott tube was introduced into the distal loop of the colostomy (fig. 3). Irrigations were started (fig. 4) as soon as the tip of the Miller-Abbott tube was in satisfactory position.

In addition to the procedure presented, this patient illustrates the difficulty encountered in differentiating between benign and malignant lesions of the descending colon. A biopsy is often necessary to be sure of the type lesion. Only through this method could an accurate diagnosis be made in the case presented.

Summary

A method of preparation of left sided colon lesions using a de-

functionalization procedure (transverse colostomy) and the Miller-Abbott tube is presented along with an illustrative case in which this procedure was successfully used. Through this method, the lesion, whether producing complete or partial obstruction, can be prepared for operation as quickly as the general condition of the patient can be prepared for definitive surgery. This method greatly reduces the time required, especially in infections such as pyogenic granulomas associated with diverticulitis of the sigmoid, in preparing patients for resection of left colon lesions. It is more satisfactory to the patient than the conventional methods of deflating and cleaning this section of the colon. The apparatus used is simple in construction and in its proper use.

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ETIOLOGY, PREVENTION AND TREATMENT OF VESICOVAGINAL FISTULA

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THE management of vesicovaginal fistula has been somewhat simplified during the past decade. Surgeons and urologists seem to have joined with the gynecologists in studying the causes, prevention and treatment of this lesion of the bladder. Methods of investigation and of repair have been standardized. Because of this united effort of the various specialists interested in this subject, the lesion does not appear to be as formidable as it once did. The incidence of postoperative recurrences has been greatly reduced, so that they now occur only in the most difficult cases.

ETIOLOGY AND PREVENTION

Vesicovaginal fistula is caused by difficult parturition and operations on the uterus and bladder; occasionally it follows the application of radium for cancer of the uterine cervix.

The fistula which occurs after delivery used to be the most commonly seen; but the incidence of this type has been reduced, coincident with the improvement in obstetric teaching and practice, so that now such a fistula is rarely seen at the Mayo Clinic. The type of vesicovaginal fistula we see today is chiefly that which occurs postoperatively. The operation which is most usually involved is total abdominal hysterectomy; the next in order of frequency are vaginal hysterectomy and vaginal plastic operations. The fistula which develops from radiation therapy for carcinoma of the cervix is not common, but when it is seen it presents a serious surgical problem.

Since the frequency of occurrence of vesicovaginal fistula which follows abdominal hysterectomy is increasing, greater effort must be made to prevent such a surgical accident. One reason for this increase has been the great number of papers published in which total abdominal hysterectomy is advocated as a routine procedure whenever abdominal hysterectomy is indicated. The author is not in accord with such teaching because it is not practical to apply one surgical procedure to an organ such as the uterus with no regard for the type or location of the inherent lesion. For example, car-

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From the Division of Surgery, Mayo Clinic.

cinoma of the fundus of the uterus demands complete removal of the uterus when this lesion is operable. But total hysterectomy certainly is not demanded in the case of such benign lesions as fibroid tumors, especially if the cervix is normal, and particularly if the patient has not had children. Furthermore, there is the occasional instance in which the patient has a very short anterior vaginal wall and perhaps some elongation of the cervix, in which circumstance it would be difficult to do total hysterectomy without an increased risk of damage to the bladder. Total hysterectomy can be done successfully by a competent surgeon, but not by one with less ability without an increased risk. Total hysterectomy performed for extensive endometriosis is another example of a case in which this operation, carried out for a benign lesion, can be very hazardous to the bladder. Frequently disseminated endometriosis is present, with multiple lesions involving the wall of the bladder at the reflection of the peritoneum from the anterior wall of the uterus; also, the bladder occasionally is drawn toward the lateral wall of the cervix near the uterine vessels by these lesions. It is in such instances that the risk of producing vesicovaginal fistula incidental to performance of total abdominal hysterectomy for endometriosis is much too high, in average hands, to justify performance of such an operation. Similar distortions may be seen in pelvic infections for which hysterectomy is required, but these distortions and fixations actually are due to the recurring and long-standing cellulitis.

It seems to the author that the usual manner in which a vesicovaginal fistula develops after total abdominal hysterectomy is as follows. It is possible for a surgeon to incise the bladder without knowing that he has done so, particularly if the bladder has been emptied by catheter preceding the operation. Second, and what the author believes is the most common cause, is the placing of a suture through the wall of the bladder when the vaginal vault is being closed. Also, when a stick tie is being placed to ligate the uterine vessels, the bladder may be caught near the ureterovesical juncture and vesicovaginal fistula develop therefrom. Such a fistula becomes apparent within about a week after the operation. This period is the amount of time required for the suture to cut through the wall of the bladder. If the fistula occurs immediately after the operation, it must certainly be the result of an unrecognized injury of the bladder. Such injuries can be prevented by certain maneuvers which the author wishes to recommend, since he feels that prevention is equally as important as cure in the treatment of this condition.

To avoid the production of vesicovaginal fistula after total abdominal hysterectomy, the operation should be done under direct

vision, without the causing of trauma or hemorrhage. If every step of the operation is conducted under direct vision, and no structure is incised or sutured except when it is plainly seen and identified, then a fistula will not be caused. It is especially important that after the peritoneum has been incised and pushed down from the uterus, the bladder be pushed downward at least 1.5 cm. to expose that much of the attachment of the pubocervical fascia at the point of its attachment to the cervix. It is only after this maneuver that the clamps can be placed safely on the uterine vessels and the cervical branches of the uterine artery without the risk of catching a tiny segment of the bladder in the tips of the forceps. Catching of a small portion of the bladder in the forceps is more likely to occur in the presence of very active bleeding from some of the larger veins of the broad ligament. For this one reason alone, it is a good routine procedure, in the performance of abdominal hysterectomy, to cut the round ligament separately from the adnexal ligament. If this is done, exposure of the vessels of the broad ligaments will be adequate, so that the clamps can be applied effectively in the proper places.

In cases in which there are interligamentous fibroids, adenomatous lesions, pelvic endometriosis or chronic pelvic cellulitis, the normal anatomic relationships or positions of the vessels and the ureteropelvic segment of the wall of the bladder may be markedly distorted. Therefore, greater caution must be observed in the conduct of total hysterectomy in these situations if subsequent trauma to the bladder and the development of a vesicovaginal fistula are to be avoided.

There is a step in the technic of total abdominal hysterectomy which the author has observed to be important as an aid to visualization of the structures and also as a means of assistance in the prevention of serious hemorrhage. This consists in the surgeon's holding the pelvic structures to be removed by one hand and his maintaining constant traction on them, because under moderate traction the anatomic aspects of these structures are more clearly defined and hemorrhage from veins which may be torn cannot be excessive. In this connection, the author wishes to advise against the use of right-angle clamps or any type of clamp which may be used to close the vagina after complete removal of the uterus. The risk of injury to the bladder is too great when such clamps are employed, whereas the risk of serious infection presented by the open vagina is very small indeed.

A fistula which follows vaginal hysterectomy without doubt is produced in exactly the same manner as is that which follows ab-

dominal hysterectomy. That is to say, it is brought about by a suture which is passed through the entire wall of the bladder or by an incision made in the wall of the bladder which, in either instance, is unobserved at the time of surgery. The same principles, therefore, of direct vision and hemostasis are most important in the prevention of this type of fistula after either vaginal hysterectomy or vaginal plastic procedures carried out for cystocele decensus and amputation of the cervix.

The prevention of vesicovaginal fistula after radiation for carcinoma of the cervix is a problem for the radiologist. As long as this treatment remains in the hands of an expert radiologist, the occurrence of this type of fistula will be held to a small figure. Radium is a very powerful element and cancer of the cervix is a very serious disease, so that expert care in handling both must be used.

Urologic Investigations

When a patient presents herself with a vesicovaginal fistula, the first steps of investigation are urologic. It must be determined whether one fistula is present or several are present. The exact situation and size of the lesion, presence or absence of cystitis, and involvement or noninvolvement of the upper part of the urinary tract must be ascertained.

The situation of the fistula is of particular importance in regard to surgical treatment, recurrence and course of action with respect to the involved upper part of the urinary tract, if it is involved. For example, a fistula which involves the ureteral meatus usually is associated with a history of periodic chills and fever, especially if there has been any obstruction to the ureter.

Occasionally, the fistula is ureterovesicovaginal in type; this point must be determined accurately before treatment is instituted. In such a case there will be ureterectasis, pyelectasis and perhaps cortical or parenchymal abscesses. The management of the fistula then becomes, first of all, a renal problem or a ureteral problem, and secondarily a fistular problem. If the kidney is badly infected and hydronephrotic, nephrectomy is the best procedure, provided, of course, there is a normal kidney on the opposite side. A point of particular importance is that the surgeon often is tempted to repair the ureteral defect extravesically and thus save the kidney, but failure usually ensues and subsequent surgical procedures are necessary in most instances. The best extravesical procedure, if the kidney is reasonably normal and the ureter is not dilated, is to reimplant the ureter in the bladder well above the fistulous opening without the

exertion of tension on the ureter. If the ureter is under tension, urine cannot flow adequately and the ultimate result will be a functionless kidney, which may or may not require subsequent nephrectomy. After the ureter has been transplanted, the vesicovaginal fistula can be easily repaired, since the surgeon does not have the ureterovesical orifice with which to contend.

One of the most common sites at which a vesicovaginal fistula occurs is just above or parallel to the ureterovesical juncture as a result of injuries which have been produced by the forceps or stick tie in clamping and ligating the uterine vessels during abdominal hysterectomy. Because of the proximity of such a fistula to the ureter, special care must be used during repair to prevent ureteral obstruction and recurrence of the fistula. When a fistula is situated in or near the ureteral meatus, the urologist must make a careful survey of this area and the upper part of the urinary tract.

So far as situation is concerned, those fistulas which are located in the midportion of the trigone or posterior to the trigone usually are uncomplicated and single, and the upper part of the urinary tract is normal. When the fistula involves the sphincter the problem of repair becomes somewhat more complicated, so that in order to secure the best results, accurate specification as to location of the fistula on cystoscopic examination is essential.

The description of a fistula on cystoscopic examination is very useful because many times scar tissue extends transversely or longitudinally from the fistulous opening. This scar is always very thin, and often is the site of a recurring fistula, so that it becomes necessary to excise all scar tissue if the surgeon is to avoid possible recurrence and is to secure accurate healing of the defect in the bladder. When this scar tissue is excised, the fistula always becomes a larger one than was originally supposed. The direction of the scar tissue will then determine whether the fistula is to be repaired anteroposteriorly, transversely or perhaps diagonally. Portions of granulation tissue in the bladder may be the sites of small secondary fistulas or potential defects in the bladder which may become fistulas. Examination in such a case is an important urologic function.

The appearance of a fistula which has been produced by radium is characteristic in that the mucosa appears lighter and is scarred for a variable distance around the fistula. This scarring is caused by loss of the blood supply, and will not heal well if it is repaired. Hence, if repair is to be considered, this entire area, which previously has been described on cystoscopic examination, must be excised.

A fistula located anterior to the sphincter becomes a urethro-

vaginal fistula, but on vaginal examination it may appear to be a vesicovaginal fistula. Localization in such a case is important so far as repair is concerned, since tissues suitable for repair are scanty around the urethra, in contrast to those at the base of the bladder.

Infection in the bladder, which used to be a serious complicating factor, has now been reduced by the use of sulfonamide drugs and penicillin. Formerly, incrusted cystitis was a common observation in association with some of the larger fistulas because of the presence of urea-splitting organisms. Also, these infections were very potent causes of recurrences because the site of repair became infected and broke down. The author finds it worth while now to carry out these repairs when the urine has been made slightly acid or neutral by maintenance of the pH of the urine at about 5 or 5.5. This concentration is to be watched closely during convalescence of the patient, to prevent infection.

Surgical Repair

Before the attempt is made to repair any vesicovaginal fistula, the question of a vaginal, transvesical or transperitoneal approach to the fistula must be considered. At the Mayo Clinic the attitude toward these various methods can be expressed best by the statement that 99 per cent of all vesicovaginal fistulas in our hospitals are repaired by the vaginal approach. An attempt will be made to state clearly our reasons for this attitude. Mobilization and excision of scar tissue are two procedures of utmost importance to successful closure, and they are more easily accomplished by way of the vagina. The entire urethra, trigone and base of the bladder can be exposed by the vaginal approach. If the fistula followed delivery, repair of a cystocele or a urethral diverticulum, or if it developed after supracervical hysterectomy, adequate exposure and method of approach are best obtained with the patient in the lithotomy position. However, if a fistula has occurred after total removal of the uterus, either vaginally or abdominally, mobilization and excision of scar tissue can be accomplished best vaginally, with the patient in the Kraske position, which is in reality a modified Sims' position (knee-chest). Exposure, which is so essential, is excellent when this position is employed. The vaginal vault, which usually is movable, falls forward and the fistula can be seen easily, just as Marion Sims stated in his original contributions. A Sims speculum is held against the perineum, and the line of closure of the vaginal vault after hysterectomy is easily located and palpated. Generally, the fistula is situated in this area. In mobilizing the bladder, the surgeon should incise the vaginal wall well above the fistula, well below it and

about 1 cm. around the fistula. The vaginal wall is reflected from the bladder at least 2 to 2.5 cm. That part of the vaginal wall adjacent to the fistula is held by forceps or clamps. The cul-de-sac of Douglas is then opened so that the surgeon's finger can explore the pelvic cavity to separate any portion of the small bowel or sigmoid from the bladder. The bladder can then be pulled more into the vagina, and all scar tissue around the fistula can be excised easily under direct vision of the surgeon.

The defect in the bladder is closed in layers either anteroposteriorly, transversely or diagonally, depending on which direction the course of the fistula is found to have after the scar tissue has been removed.

The technic of closure and the suture material to be used seem to have an important effect on the success of the operation. The author recommends that absorbable suture material be used throughout, so that there will be no sutures to be removed secondarily. The first row of sutures is made with 000 chromic catgut. This suture brings only the mucosa together and does not enter the bladder; it is a continuous stitch. The wall of the bladder is now closed in layers. The second row of sutures is made with 00 chromic catgut; it begins 1 cm. beyond the first row and extends 1 cm. beyond the point at which the first stitch ends. The third row of sutures is made with 0 chromic catgut; this row completes closure of the bladder by starting and ending 1 cm. beyond the second row. The third row is so placed that all dead space along the site of repair of the wall of the bladder is completely obliterated. The final step is closure of the vaginal wall with interrupted number 1 chromic catgut suture material. The vaginal wall is always incised around the fistula anteroposteriorly, even though the defect in the bladder may have to be repaired transversely.

The type of repair described in the foregoing paragraph has been highly successful, and is recommended. Obviously, this type of operation cannot be done transvesically or transperitoneally. The author does not wish to say that such a fistula cannot be repaired by these other methods, for it can be so repaired. Occasionally, in fact, the transvesical or transperitoneal type of operation is definitely indicated, as, for instance, when a fistula is situated high in the vault, fixed and involved with the colon. In such an instance, however, the risk is much higher and the operation is more difficult than would be true otherwise. If the fistula fails to heal, the result usually is an extra fistula situated above as well as the one in the vagina, and a much sicker patient.

Should a recurrence develop, repair ought not to be attempted for 3 to 6 months later. Such a period is approximately the time required for all inflammation and edema to disappear and for an adequate blood supply to return to the tissues. Occasionally, if a small leak follows what seems to be an adequate repair, the fistula will close spontaneously during the healing process if a catheter is kept in the bladder. Also, tiny openings may be closed later by very light fulguration and the use of an indwelling catheter.

Repair of a fistula subsequent to radiation therapy for carcinoma of the cervix should not be attempted for at least 3 years, for this is the minimal period in which the surgeon can be reasonably sure that there will not be a recurrence of the carcinoma. In most instances it will be wiser to transplant the ureters to the sigmoid in one stage, after careful preparation of the bowel. The oral administration of succinylsulfathiazole and the hypodermic administration of streptomycin reduce the bacteria in the colon, so that the risk of transplantation now is much safer than it was formerly.

Postoperative Care

Finally, the importance of postoperative care should be emphasized. The patient remains on a Bradford frame suspended about 2 feet from the surface of the bed for 2 weeks. The catheter drains directly into a small basin on the bed, so that the patient or any attendant can see at a glance whether or not the catheter is functioning. The catheter is irrigated frequently to prevent plugging, and the bacterial content of the urine is controlled by the use of sulfonamide drugs and mandelic acid.

Postoperative examinations of the vagina are not permitted until one week after dismissal of the patient from the hospital, since there is nothing to be gained by such examinations, and they may do much harm if healing is delayed.

MISTAKEN SURGICAL DIAGNOSES IN HOOKWORM DISEASE

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THE textbook case of hookworm disease is that of a potbellied, edematous, dull-witted individual suffering from severe anemia. In our experience this picture has been rare. We have found the usual case to be more insidious in its manifestations and frequently of importance in the differential diagnosis of other diseases. Hookworm infestation is not of negligible importance to the surgeon because of the occurrence of abdominal pain in patients with this disease who have been referred for operation for various mistakenly diagnosed abdominal disorders. It has long been recognized that hookworm disease may produce abdominal symptoms. That these symptoms may simulate appendicitis, peptic ulcer, and other abdominal diseases is a concept of which we have found very little in medical literature. It is this fact that has prompted this study.

The life cycle of the hookworm is well understood.[1,2] The adult worm lays its eggs in the intestinal tract of the host. These are passed in the stool. The ovum develops into the first larval stage which may remain dormant awaiting more favorable climatic conditions or may develop into the second larval form. This larva is motile and is capable of moving several centimeters from where the ovum was deposited. The larva then penetrates the unbroken skin of the host, usually that of the hands or feet. Upon penetrating the skin an allergic reaction to the larva takes place producing an itching eruption commonly called "ground itch." The parasite penetrates the small blood vessels through which it makes its way to the lungs. In the lungs it breaks through into an air sac, travels up the respiratory tree into the pharynx, and is finally swallowed. In the intestine it reaches maturity and begins to lay eggs; and the life cycle is complete.

Pathologically there are three manifestations of hookworm disease which are of clinical interest: The skin lesions produced by the penetration of the skin by the larva, the respiratory symp-

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toms caused by the larva leaving the blood stream and entering the lung, and the blood loss and ulceration of the bowel produced by the activities of the adult worm. It is in the latter that we are interested. The adult worm lying in the mucosa of the small intestine attaches itself to the villi and feeds largely upon blood (figs. 1 and 2). The parasite moves from place to place in feeding and leaves small areas from which it has fed which may become ulcerative. Smith[3] pointed out the frequency with which abandoned bites of hookworm become infected with pyogenic organisms and develop into ulcerations which usually measure from 3 to 5 mm. in diameter. The young worms may form blood cysts in the intestinal wall. There is evidence that although the worms go to the bottom of the crypts of Lieberkuhn they do not penetrate the intestinal mucosa.[2] Bonne[4] has reported 10 cases of penetrating ulcerations of the bowel produced by the destructive action of ancylostomes on the intestinal wall.

As a basis for this report, we have analyzed all cases of hookworm disease admitted to the Orange Memorial Hospital because of abdominal complaints from 1939 to 1946. No routine investigation was made in all hospital admissions to determine the presense of hookworm infestation incidental to other diseases. Stool analyses were made only when indicated.

Analysis of Cases: 46 cases of hookworm disease causing symptoms sufficiently severe to warrant hospitalization have been admitted to the Orange Memorial Hospital in the past 7 years. Of these, 23 have complained of abdominal pains; 12 of the 23 were admitted to the surgical service. Of this 12, 4 were operated upon for acute appendicitis, 1 of this 4 had a perforated appendix with generalized peritonitis. In this case the hookworm infestation was considered to be incidental to the primary disease of the appendix.

Admission Diagnosis: The admission diagnosis was usually made by the admitting intern and involved not only the primary diagnosis but other possibilities to be ruled out. The most frequent diagnosis was that of acute appendicitis, made in 9 cases; next, hookworm disease, in 6 cases; and peptic ulcer and acute salpingitis, in 3 cases each. Other diagnoses considered were as follows: Non-specific colitis, 2 cases; acute pancreatitis, 1; acute cholecystitis, 1; bronchopneumonia, 1; pulmonary emphysema, 1; typhus, 1; gastrointestinal allergy, 1.

Abdominal Complaints and Points of Tenderness: Abdominal discomfort ranging from a generalized aching to a knife-like stabbing pain in a specific area was a symptom of which each patient

complained. This is significant in that no effort was made to elicit a history of abdominal pain and in each case the information was offered voluntarily. A distinction has been made between abdominal complaints, a subjective matter, and location of pain, an objective finding determined by examination of the patient: 10 patients complained of generalized abdominal pain; 8, of pain in the right lower quadrant of the abdomen; 3, of lower abdominal pain, and 1 each of pain in the epigastrium and about the umbilicus. Upon examination the point of maximum abdominal tenderness, in 9 cases, was found to be in the right lower quadrant of the abdomen; in 5, generalized throughout the abdomen; in 3, in the epigastrium; in 2, in the lower part of the abdomen; in 1, in the left half of the abdomen; and in 3 there was no abdominal tenderness at all.

Blood Studies: The lowest red cell count was 3,300,000. In 3 cases the initial count was less than 4,000,000; in 6, between 4,000,000 and 4,500,000; and in 9, greater than 4,500,000. The white cell counts ranged from 3,900 to 25,000. Of the 23 cases studied, 16 were greater and 7 less than 7,500. Hemoglobin determinations were made in only 18 of the 23 cases. These ranged from 56 to 101 per cent. Of these, 12 were 80 per cent or greater and 6 were less than 80 per cent. Eosinophile counts ranged from 0 to 31 per cent: 15 were less and 8 were greater than 5 per cent.

Admission Temperatures: Admission temperatures ranged from 98° F. to 104° F.; 1 was 99° F. or less; 12, 99° F. to 100° F.; 7, 100° F. to 102° F.; 2, 102° F. to 104° F.

Gastrointestinal Symptoms: Diarrhea was an uncommon symptom, appearing in only 4 cases. In each of these cases it was violent and marked by the presence of frank blood in the stool. Occult blood occurred in almost every case. Nausea and vomiting occurred in 13 cases.

Other Symptoms: Respiratory symptoms occurred in only 2 cases. On admission to the hospital one of these patients complained of pain in the right side of his chest. X-ray examination showed some infiltration of the lower lobe of the right lung. Subsequently, multiple small abscesses developed in this lung. The presence of hookworm infestation was a complication of the primary pulmonary disease. In the other case a diagnosis of broncho-pneumonia was made but no organism was ever identified. It is possible that the hookworm produced the respiratory disturbance. Weight loss was a complaint in 4 cases and weakness in 5.

Age Incidence and Locale: The ages ranged from 2 to 68, with the average age 27.7 years; 5 patients were 12 years of age or less,

Fig. 1. Photomicrograph of Necator americanus sucking intestinal mucosa.

Fig. 2. Hookworms inside the bowel. (Reproduced by permission of Chandler, Asa C., Hookworm Disease, New York, The Macmillan Company, 1929, p. 245.)

12 between 12 and 30 years, and 6 older than 30; 15 lived in rural districts and 8 in urban areas.

Discussion

An insidious type of hookworm disease characterized more by intestinal symptoms than by those usually described has not been a rarity in our experience. This series is admittedly small and constitutes a very small percentage of the total admissions to the hospital; however, there are several factors to be considered in explanation of this fact. First, no particular effort was made to identify hookworm ova in the stools of all hospital admissions. Had this been done undoubtedly the incidence of infestation would have been much higher. Second, no stool analyses were made routinely in those cases presenting abdominal symptoms in which at operation there was no demonstrable intra-abdominal abnormality. Had the stools of these cases been carefully studied for ova it is conceivable that hookworm disease may have been a common causative factor.

The disease most commonly simulated was acute appendicitis. Certainly, no surgeon could be blamed for operating upon a patient who presented a picture of acute onset of abdominal pain, localizing in the right lower quadrant of the abdomen and accompanied by nausea, vomiting, temperature elevation, and leukocytosis. Although increased eosinophile count was found in only 34.8 per cent of our cases we have made it a rule not to operate upon so-called "atypical" cases of appendicitis in which there is a high eosinophile count until hookworm disease has been ruled out. As has been pointed out by Strong,[5] eosinophilia is greatest early in the disease and as the patient establishes a tolerance to the parasites or as anemia becomes more pronounced, the eosinophile count drops. In patients who have been infested with worms for several years the eosinophile count may be low to normal. The absence of eosinophilia is of little diagnostic importance while its presence may be of great significance.

A case in point is that of a 27 year old white female recently referred to one of us as having acute appendicitis. She had a history of acute pains throughout the abdomen beginning 4 days before admission. The pain lasted 2 days and spontaneously subsided. Twelve hours before admission the pain recurred. This time the pain was more acute and gradually shifted to the right lower quadrant of the abdomen. The patient had been nauseated and vomited three times during this 12 hours.

On examination she was found to be an obese white female in moderate distress. There were no abnormal physical findings other than tenderness throughout the lower part of the abdomen, especially in the right lower quad-

rant. Pelvic examination revealed tenderness in both adnexal regions but this was not incommensurate with the abdominal findings. The picture was strongly suggestive of acute appendicitis.

Laboratory findings were as follows: Urine, negative for albumin, sugar, occult blood, pus, and casts. The red cell count was 4,100,000; white cell count, 7,200; hemoglobin, 81 per cent; eosinophiles, 14 per cent; stab, 8; segmented, 40; lymphocytes, 38. The stool examination showed a moderate number of Necator ova.

She was given anthelmintic treatment and the abdominal symptoms subsided. Subsequently a laparotomy was performed for an ovarian cyst. The appendix was removed at this time and the pathologist reported it to be normal.

Recently, Rogers and Dammin[6] reported 50 cases of ancylostomiasis occurring among American troops in Burma. Their studies are not entirely analogous to ours because they were dealing with old world and we with new world hookworm and all their cases were acutely infected whereas ours were undoubtedly, in many instances, chronic. Nevertheless, it is interesting to compare our findings with theirs.

	Roger-Dammin Series 50 Cases		Our Series 23 Cases	
	No. of Cases	Percentage	Our Series	Percentage
Abdominal pain	42	84	23	100
Weight loss	29	58	4	17.5
Respiratory symptoms	29	58	1	4.3
Abdominal tenderness	32	64	20	87
Vomiting	27	54	13	56.7
Diarrhea	25	50	4	17.5

Rogers and Dammin mentioned that in many instances it was the high eosinophile count, apparently discovered in making routine blood counts, that called their attention to the stools. In our series this would not have been a reliable test. Using the eosinophile count as a criterion for distinguishing between acute and chronic infestations 64.2 per cent of our cases were chronic. In all probability this accounts for the lower incidence of weight loss and of respiratory symptoms in our series, although the difference in the type of hookworm involved probably plays a part.

It is interesting to note that only 1 of the 23 cases studied was a negro. Whether this is because of the relative immunity to hookworm among negroes or because colored people usually do not seek hospital attention as readily as do white people we are unable to say. Black[7] reported an incidence of hookworm infestation of

4.4 per cent among 188 negroes admitted to the Florida Tuberculosis Sanatorium in this area over the period covered by our study as opposed to an 8.5 per cent incidence of positive stools in white people. These figures are in accord with our experience.

Conclusions

A series of 46 hospital admissions having hookworm disease was studied, 23 of these admissions having abdominal symptoms. From the data obtained we believe the surgeon should be aware of the possibility of hookworm infestation producing abdominal symptoms simulating appendicitis, peptic ulcer, and other surgical diseases of the abdomen.

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OBLIGATIONS AND OPPORTUNITIES OF INDUSTRIAL SURGERY

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SEVERAL years ago William H. Rose,[1] in an article entitled "Industrial Surgery," defined it as follows: "a combination of preventive and curative medicine, applied to men and women."

In order properly to evaluate the obligations and opportunities of Industrial Surgery, I would like to have you think with me in a very general way of just who are Industrial Surgeons. Long since it has become a recognized fact that some surgeons do practically full-time service for industrial concerns. The large railroads, factories, mining companies, steamboat lines, airlines, mills, steel companies, automobile plants, are some of the employers of full-time surgeons. Then, too, the insurance companies, especially compensation companies, to some extent. These are some of the most outstanding employers of Industrial Surgeons. But my thought is that the above mentioned by no means constitute strictly the Industrial Surgeons, for in the final analysis it will be found that nearly all surgeons, at some time, do industrial surgery.

In a survey made in the State of Massachusetts as far back as 1927, it was estimated that 93 per cent of all surgeons did more or less Industrial Surgery.

Again in 1942 E. M. Stevenson[2] writes: "The situation is not exaggerated when it is said that fully 99 per cent of all doctors, to some extent, do industrial surgery, yet 25 per cent or 30 per cent major in industrial practice."

After attending an Industrial Surgeons' meeting in New York City and hearing four papers read and discussed by Industrial Surgeons, Bradley Coley stated that he would like to have every word of it bound so that it would not be forgotten, but he also believed that it was of such importance it would be remembered without binding.

Again, as far South as Augusta, Georgia, we read a very brilliant symposium on "Some Problems of Industrial Practice" read at a meeting of the Georgia Industrial Surgeons' Association.

Industrial surgery is necessarily practiced in rapidly increasing volume in the highly industrialized North, and on the Eastern and

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Western Coasts, and to a lesser degree in the more sparsely populated South and West.

B. L. Vosburgh, Medical Director, General Electric Company, states: "Industrial Medicine comprehends (1) A study of physical fitness in respect to employment; (2) A study of working environment; (3) The diagnosis and treatment of injuries sustained at work; (4) The diagnosis and treatment of occupational diseases; (5) The diagnosis and treatment of personal illness occurring while at work; (6) Evaluation of disability, which is of great importance."[3]

The industrial physician or surgeon has a much greater variety of problems to solve than has any other specialist for he must be internist, surgeon, orthopedist, toxicologist, radiologist, psychiatrist, etc.

Studies of the American College of Surgeons indicate that illness causes fifteen times as much absenteeism as industrial injuries. I wonder if we have given this phase a proportionate amount of attention?

Industrial medicine needs not only guidance but more abundant recognition as one of the important medical specialties. Therefore, when the title "Industrial Surgeon" is used it should be understood to include physicians and specialists in different branches of medicine, as well as surgeons, all of whom are giving professional service to employees in various branches of industry.

In the present mechanical age with the advent of more and newer mechanical devices, in this age of speed and super-speed, with more and faster planes, cars and trains the tendency is toward more accidents, and, in passing, we realize that accidental injuries to employees comprise a considerable number of the causes requiring industrial surgery.

It is true that the local, full-time plant surgeon attends most of the cases, but it is equally true that many are referred to the larger centers throughout the country for specialty operations, for reconstruction, for plastic surgery, all of the cases being directly or indirectly classified as industrial surgery. Therefore, it is not necessary for a surgeon to be in the direct employee of factory, mill or mine to do Industrial Surgery.

Obligations

The surgeon's chief concern should be first to effect a complete cure if possible by saving life and limb, and second to effect the cure

as speedily as possible, and third, at a reasonable minimum expense. The wage earner's production is needed at home; likewise he is needed by his employer; therefore any unnecessarily long delayed treatment is expensive for his family in loss of his wages, and expensive to his employer in compensation paid for his time off period in temporary total disability, and in permanent disability in the event of failure to effect a complete cure, thus straining and unbalancing the entire economic picture.

No discussion on the obligations of industrial medicine and surgery would be complete without giving some consideration to the medical needs of small industrial plants; that is, plants employing less than 500 workers.

When it is realized that fully 90 per cent of the industrial plants of the United States have from 25 to 500 workers and cannot afford to provide a full time physician or nurse, and when it is considered that the industrial accident frequency and severity rate is distinctly higher in smaller plants (The National Safety Council found, in 1936, 62 per cent more lost time injuries in smaller plants and the American College of Surgeons in a survey of 299 companies employing 1,237,755 workers found 60 per cent greater costs paid by smaller industrial concerns for medical service) the magnitude of this need for small plant medical service becomes apparent.

The conventional on-call plant physician or surgeon is, at the most, able to take care of only emergency medical needs. This arrangement has proved totally inadequate in providing an acceptable medical program for even the smallest of industrial plants.

While as yet no prototypic formula exists for solving the small plant medical problem, certain progressive small plant cooperative, but experimental, medical service plans have been recently reported in the literature. Such plans are: (1) "The Philadelphia Health Council and Tuberculosis Committee's Health Service to Small Plants,"[4] (2) "The New Haven Industrial Medical Service" which was set up in 1940 through the cooperation of the New Haven County physicians with the Yale School of Medicine; (3) "The Berkeley Plan" (being developed by the Department of Hygiene of the University of California as a two year research study and thesis); and, (4) "A Cooperative Small Plant Health and Industrial Hygiene Program in New York City."[5]

Certainly this need for medical service in the small industrial plant must be faced by those of us who are engaged in the practice

of industrial medicine and surgery and recognized as a real obligation if not an opportunity.

Opportunities

For the purpose of our consideration here it is assumed that all surgeons are graduates of Class A Medical Colleges and trained by internships and residencies to a high degree of competency. Therefore, many salaries and private openings are awaiting the young surgeon where he can enter at once into the active practice of his chosen profession with earnings far in excess of his brother practitioners who ofttimes have too long a waiting period to build up a practice. Also, for the more highly specialized surgeon in the fields of reconstructive surgery, plastic surgery, and the like, there will always be the unusual cases for reference to him. And the industrialist as well as the compensation carrier have found it far more economical to pay a good surgeon well for restoring the employee instead of paying much more for permanent disabilities which would ensue otherwise.

The importance of so-called Industrial Surgery has been considered sufficient to attract the attention of almost all state medical associations, as well as the American Medical Association and regular and special committees are designated for the purpose of studying and giving full recognition of this important branch of medicine.

For many years there have existed many local county and district societies and associations of Railroad Surgeons, as well as other larger sectional organizations of Railroad Surgeons devoting a large part of, and in many instances all of, their time to the care and treatment of railroad employees.

In *The Southern Surgeon,* in June, 1942, there was an article published, the subject of which was "The Part the Railroad Surgeon May Play in Industrial Surgery";[6] it is as follows:

> "The selection of employees who are physically fit and the safeguarding of their health and the treatment and rehabilitation of injured employees is the direct responsibility of the Railroad Surgeons. The railroads of this country have an army of surgeons totaling 16,188 and one and all they stand ready to give their best to our country in its emergency."

In more recent years the surgeons and physicians for the coal industry and its employees have formed associations for the purpose of improving and rendering a greater and more expanded service to their patients, an outstanding example of which is the Association of Mine Physicians, comprising doctors of several states in the Appalachian coal fields.

Financial Returns

"The laborer is worthy of his hire." At the present wage levels all industrial workers are able to pay a surgeon a reasonable fee for the exercise and application of his skill, and with the existing levels of compensation required by the state laws of employers it is far more economical for the employer to pay a liberal salary, or fee, if on a fee basis, and thereby eliminate the excessive burden of compensation paid to the employee.

Then, too, with the advent in recent years of the numerous prepayment plans for hospitalization, the average patient with this coverage has more money left to take care of his bills for professional services, and further, with the increased activity of the insurance companies in providing hospital and in many instances professional services, there is ample assurance for the surgeon to be rewarded in a financial way for his attention and services.

Contract or List Practice

The attempted partial coverage of this subject herein would by no means be complete without a discussion of this form of prepayment plan of medical services. It is not strictly a prepayment plan, but is rather a pay-as-you-go plan. For a longer time than the oldest here can remember this plan has been used, successfully and satisfactorily, by many industrial employers, and especially by the mining communities of many states and sections. This plan does not concern the injured men who sustain their injuries in the course of their employment, but rather it is for the purpose of providing complete medical and surgical protection and services for all the employees, their families or other dependents, including all surgical operations and treatments not incurred in line of duty as an employee of an industrial concern.

This plan is simple and in most places where it is operated each employee grants the company the right to deduct a stipulated amount from his or her wages each month and give the total amount so collected for all on the list to the doctor who has previously contracted with the group to furnish and render the services specified. The amount collected is usually paid to the doctor semi-monthly, thus making a true pay-as-you-go plan. However, it resolves into a practical prepayment plan if an employee does not need this service for a period of months following the institution of the contract.

During the past few years we have heard quite a lot about prepayment plans, and the profession has been much concerned about certain proposed measures which would cause regimentation to an

extent unbearable to many freedom-loving doctors. A righteous resistance and, in the minds of some, an indignant resentment have developed to such plans or proposals by our Government. But on reliable authority I am informed that our medical organization at a meeting in Washington, D. C., after advancing the theory that the medical profession could solve the difficulties and deficiencies of the medical service of the country, referred to and offered as an example the contract or list practice as a successful method of giving and obtaining medical and surgical service, the principle of which has been proved for generations.

Since Industrial Surgery is so closely linked with traumatic surgery, and since the following quotation is equally good and applicable to both, I want to give you here the following: "The Ten Commandments of Traumatic Surgery" by John J. Moorehead, which I found framed and hanging in the office of an active young Industrial Surgeon:

I. Thou shalt have no god of trauma other than the welfare of thy patient.

II. Thou shalt not bow down to any graven image except Knowledge and Experience.

III. Thou shalt not take in vain the name of those who diligently seek the welfare of thy patient.

IV. Remember to give thy patient rest on the day following injury.

V. Honour the parents of traumatic surgery who gave birth to and practiced this branch of general surgery.

VI. Thou shalt not kill thy patient by neglect nor by the practice of alien doctrines.

VII. Thou shalt not commit adultery by conniving clinic crimes designed to conceive such offspring as infection, deformity, and disability.

VIII. Thou shalt not steal the ideas of thy brother practitioners without due recognition.

IX. Thou shalt not bear false witness against thy brother practitioners who probably did as you would have done.

X. Thou shalt not covet thy fellow practitioner's skill, his equipment, his hospital nor anything else that is his, except his reputation, his knowledge, and his experience.

In conclusion and bringing us up to 1947 I want to quote from

the Industrial Health Bulletin No. 29 of the Council of Industrial Health of the American Medical Association as follows:

"Principles for sound progress of medicine in industry have been established by the American Medical Association, the implementation of these principles by the individual industrial physician in his daily professional and lay contacts will make for contributions of incalculable value to the prolongation of the lives of industrial workers and to the advancement of their comfort and peace of mind."

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SPINAL ANESTHESIA

As the search for the ideal anesthetic continues, spinal anesthesia has proved, through the years, to be a safe, non-toxic and dependable method of preparing a patient for surgery in cases in which it is indicated. It has been a valuable contribution to the surgeon and is still the anesthetic "par excellence" for abdominal relaxation. In competent hands it is easily given and requires less dosage than does any other anesthetic agent.

Spinal anesthesia is indicated in any operative procedure below the diaphragm. For gallbladder and bile duct surgery it provides complete relaxation which is so important to the surgeon in this area. For strangulated hernia and intestinal obstruction it not only gives abdominal wall relaxation but promotes intestinal motility. In obstructive conditions, diabetes, eclampsia, and cardiac and respiratory infections it is important to utilize an agent which is not only non-toxic but also one which causes little change in body physiology. Spinal anesthesia fulfills these requirements.

The chief contraindication to this form of anesthesia is disease of the central nervous system such as tumors, myelitis, multiple sclerosis, syphilis, etc. It is generally not advisable in patients suffering with advanced myocardial disease or in marked hypertension or hypotension. Cases of hypotension, however, can be controlled

with one of the vasoconstrictor drugs. Psychoneurotic individuals are best given other forms of anesthesia for obvious reasons.

The advantages of spinal anesthesia are numerous. Many patients prefer not to lose consciousness and with this anesthetic they remain conscious, can co-operate with the surgeon if need be and are able to take liquids before, during and after operation. The postoperative nausea and vomiting of many anesthetics is eliminated, gaseous distension is not as marked, need for postoperative catheterization is lessened, convalescence generally is more comfortable and postoperative complications are not so frequent since the patient is able to breathe deeply without the presence of mucous and move himself earlier. Finally the explosive risk of some of the present day anesthetics is eliminated.

One of the great disadvantages of spinal anesthesia is that the operating time is limited but this can be overcome by the use of continuous spinal anesthesia or by supplementing with other agents. For this sodium pentothal has been found particularly useful. Indeed, for those patients who must "go to sleep" pentothal may be used in conjunction with spinal anesthesia, using only enough pentothal to keep the patient drowsy.

Complications during spinal anesthesia, such as respiratory enfeeblement, severe fall in blood pressure, retching and vomiting are minimal if a good technic is used. The literature contains reports of various complications such as convulsions, myelitis, paresthesias, meningitis, etc. These, however, are rare and even the post spinal headache is seldom seen if a small caliber needle is used.

Many patients object to spinal anesthesia on the grounds of a hearsay story of paralysis following the anesthetic, but when they are pinned down the data have usually been incorrect. Much of the prejudice in the minds of the public has developed chiefly through adverse and incorrect publicity by the newspapers and also the unwillingness of the lay mind to accept having a needle put "in the spine." Much could be done to correct these false ideas through proper education; for in reality spinal anesthesia affects only the nerve roots and is not as likely to anesthetize the spinal cord as is a general anesthetic.

Although many surgeons today are utilizing the benefits offered by this form of anesthesia there are still too many who refuse to accept its advantages and in doing so deny their patients the indicated anesthetic in many instances.

ALBERT L. EVANS, M. D.

BOOK REVIEWS

The Editors of THE SOUTHERN SURGEON *will at all times welcome new books in the field of surgery and will acknowledge their receipt in these pages. The Editors do not, however, agree to review all books that have been submitted without solicitation.*

PYE'S SURGICAL HANDICRAFT. A Manual of Surgical Manipulations, Minor Surgery, and Other Matters Connected with the Work of Surgical Dressers, House Surgeons, and Practitioners. Edited by Hamilton Bailey, F.R.C.S. Eng., Surgeon, Royal Northern Hospital, London; Surgeon and Urologist, County Hospital, Chatham; Surgeon, Consolation Hospital, Lambeth; Senior Surgeon, St. Vincent's Clinic and Italian Hospital; Consulting Surgeon, Metropolitan Ear, Nose, and Throat Hospital, Potters Bar Hospital, and Essex County Council; Formerly External Examiner in Surgery, University of Bristol. Fifteenth Edition, Fully Revised, with 789 illustrations. Price $7. The Williams & Wilkins Company, Baltimore, 1947.

This popular book has again been brought up to date with a continued improvement in illustrations.

In this day of parenteral medication, all practitioners would do well to read the chapter on hollow needle technic in injection therapy. It is interesting to note that the authors recommend abandonment of the time-honored gluteal site for intramuscular injection, advocating the lateral surface of the thigh instead.

The subject of chemotherapy has been revised to include additional indications for penicillin and the sulfonamides, although topical application of the latter to wounds is still advocated.

Modified pressure dressings have been included in the chapter on burns. The authors continue to list indications for tannic acid and multiple dye coagulation of tissue. This will no doubt invoke controversy in this country.

Pye's Surgical Handicraft continues as a valuable source of information for those who are desirous of maintaining a high standard of surgical technic.

S. D. M.